경제학박사 학위논문

Studies on the Effects of the Sunday Shopping Restriction on Consumers' Purchase Behavior and Retail Market in Korea

한국의 일요일 영업 규제 정책이 소비자의 구매 행동과 소매업태 시장에 미친 영향 분석

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Abstract

This paper examines the effectiveness of the mandatory closure of large discount stores in Korea, as known as the Sunday shopping restriction, whose purpose is to protect small- and medium-sized retail stores and traditional markets, and the extent to which welfare of retail stores is affected by the policy. To evaluate whether the regulation sufficiently diverts consumers to small- and medium-sized retailers and traditional markets as what it was implemented for, we mainly investigate the impact of the regulation on the changes in consumers' choices on days and types of retail stores to shop. Then, we predict the changes in consumer spending at each type of retail stores based on the estimated changes in consumers' choices on shopping day and place. Based on the projected changes in consumers spending, we measure how much of the reductions in sales at large discount stores due to the regulation are retained, and how much of the reduced sales are transferred to smaller retailers and traditional markets. This paper further discusses possible underlying mechanism of the impact of the regulation. Particularly, we investigate the effect of consumers' purchase patterns on the impact of the regulation. To do this, we additionally conduct two analyses. First, we focus on consumers' visit patterns of each type of retail stores. By discerning consumer groups depending on their visit patterns of retail stores, we find which consumers respond most to the policy. Second, we concentrate on shopping baskets that consumers compose in each type of retail stores. We find patterns of consumers' shopping baskets and its relations to the effect of the regulation.

Keywords : Sunday Shopping Restriction, Retail Market, Consumer Behavior, Agri-food Purchase, Difference-in-Differences, K-means Clustering, Shopping Basket Analysis

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1 Introduction

The Korean government implemented a mandatory closure of large discount store in 2012. The large discount stores, such as superstores and super-supermarkets (hereinafter SSM)[1], are regulated to close stores on at least two Sundays a month by law. The regulation was implemented to protect and promote small- and medium-sized retailers and traditional markets. Because the regulation was asymmetrically targeted, the regulation has brought conflicts and lawsuits between stakeholders. In this sense, it is important to assess the effectiveness of the regulation.

This paper provides empirical evidence regarding the impact of the mandatory closure of large discount stores in Korea and assesses whether the policy effectively promotes small- and medium sized retailers and traditional markets. To evaluate whether the regulation sufficiently diverts consumers from superstores and SSMs to small- and medium-sized retailers and traditional markets as what it was implemented for, we mainly investigate the impact of the regulation on the changes in consumers' choices on days and types of retail stores to shop. Consumers can change their purchase behavior either by changing their day of shopping, changing their place of shopping or changing both. In this paper, we firstly estimate how consumers change their purchase behavior in response to the regulation. To this end, we focus

[1] A superstore refers to a mega-store throughout the paper.

on consumers' everyday decision on grocery shopping. By examining changes in visit probability of each type of retail stores on the closed Sundays and other days around the closed Sundays, we identify the effect of the Sunday shopping restriction. Then, we predict the changes in consumer spending at each type of retail stores based on the estimated changes in visit probabilities. Based on the projected changes in consumers' spending, we separately measure how much of the sales decrease at superstores and SSMs is retained due to consumers' switching their shopping day to other days around the closed Sundays, and how much of the net sales decrease is transferred to small- and medium-sized retailers and traditional markets due to consumers' switching their shopping place on the closed Sundays. By measuring the transfers of sales from superstores and SSMs to small- and medium-sized retailers and traditional markets, we evaluate the effectiveness of the Sunday shopping regulation.

To do this, we use the Korean consumer panel survey data collected by the Rural Development Administration(hereinafter RDA) for the period of 2012 to 2017, that is detailed daily scanner data on household food purchase across types of retail stores. The difference-in-differences model is applied to identify net changes in consumers' visit probabilities of each type of retail stores before and after the regulation was implemented.

The estimation results reveal that the policy leads consumers to adjust their day of shopping and place of shopping. Our result shows that consumers change their shopping day to Saturday or Monday when they cannot visit superstores or SSMs on closed Sundays, and they change their shopping place to small- and medium-sized supermarkets on closed Sundays. However, the effect on traditional markets is very limited.

To measure the changes in consumers' spending at each type of retail stores and transfers of sales between types of retail stores due to the regulation, total number of stores nationwide, daily revenues per store, and per-capita customer expenditure from various sources of data are used. The results show that superstores and SSMs experienced a total sales decrease of 3.16 trillion Korean won as a whole, with 24 mandated days of closing a year in 2017. More than 35% of a total sales decrease was retained, while 42% of that was transferred to alternative retail stores, such as small- and medium-sized supermarkets and traditional markets. The rest of the reduced sales could not be explained without applying agri-food sales ratio to total sales by retail stores. Focusing on agri-food sales, the reductions in total agri-food sales at superstores and SSMs were estimated 1.98 trillion Korean won as a whole. More than 34% of the agri-food sales decrease was shifted to a weekday in the same stores, while more than 60% of the sales decrease was transferred to small- and medium-sized supermarkets and

traditional markets. However, the portion shifted to traditional markets was estimated less than 1%. In summary, our finding implies that the regulation transfers revenues from superstores and SSMs to small- and medium-sized supermarkets, but not to traditional markets.

This paper further discusses possible underlying mechanism of the impact of the regulation. Particularly, we investigate the effect of consumers' purchase patterns on the impact of the regulation. To do this, we additionally conduct two analyses. First, we focus on consumers' visit patterns of each type of retail stores. By discerning consumer groups depending on their visit patterns of retail stores, we find which consumers respond most to the policy. To distinguish consumers into groups based on their visit patterns of retail stores, we calculate monthly average number of visits in each type of retail stores by aggregating the data by household. The Clustering technique is applied to divide consumers into groups based on their purchase patterns. The clustering results suggest that there are five groups of consumers, four groups of consumers prefer one specific type of retail stores to any others, while one group of them visits various types of retail stores for a month. Those, who prefer superstores or SSMs the most, tend to switch their shopping place only to small- and medium-sized supermarkets, not to traditional markets on the closed Sundays. Those who prefer traditional markets to other types of retail stores does not change their purchase behavior due to the regulation. Those who visit

various types of retail stores respond to the policy the most. They change their shopping day to other days around the closed Sundays, and also change their shopping place to small-and medium-sized supermarkets or traditional markets on the closed Sundays.

Second, we concentrate on shopping baskets that consumers compose in each type of retail stores. We find patterns of consumers' shopping baskets in each type of retail stores. In other words, we investigate that what product categories are purchased by consumers in each type of retail stores. To find the patterns, we use individual purchase histories in each type of retail stores from the Korean consumer panel data. By clustering the purchase records based on similarity to each other, we find the common patterns of shopping baskets in superstores, SSMs, small- and medium-sized supermarkets, and traditional markets respectively. The estimation results show that most of the shopping baskets purchased from supermarkets, SSMs, and small- and medium-supermarkets present the highest spending on processed foods, grains and alcholic beverages, whereas most of the shopping baskets purchased from traditional markets show the highest spending on fresh foods, livestock products, and marine products. This finding implies that small-and medium-sized supermarkets are substitutable to superstores and SSMs due to the similarity of their sales patterns, while traditional markets are less likely to replace superstores and SSMs even on the mandated days of closing. We also use real sales data from

small- and medium-sized supermarkets to back up the consumers' purchase patterns estimated from the clustering results. According to the analysis, the sales of all product categories, but alcoholic beverages, increased on the mandated days of closing of large retailers, and the sales of fresh foods and livestock products decreased on the days when five-day markets are open near the supermarkets.

In the sections that follow, we introduce the Sunday shopping regulation in Korea, summarize previous studies, suggest a theoretical framework for consumers' retail choice under the regulation, describe the data sources and present each of the empirical estimation strategy and results, and conclude with a summary discussion.

2 Policy Background

2.1 Sunday Shopping Restriction Policy

In 2012, the South Korean government introduced the Sunday Shopping restriction policy. Unlike the Sunday shopping restriction in many other countries, the Sunday shopping restriction policy in Korea regulates some retailers, not all. To be specific, the policy regulates business hours and days of superstores and SSMs. While the Sunday shopping regulations in other countries have been implemented for religious reasons or to protect workers' working environment and have regulated all types of retail stores, the regulation in Korea was asymmetrically implemented to protect and promote small- and medium-sized retailers and traditional markets under Article 12-2 of the Distribution Industry Development Act (hereinafter the "Act"). According to the Act, local governments[2] can regulate the business hours and days of superstores and SSMs. More specifically, local governments can specify at least two mandated days of closing each month. This policy was enacted on April 22, 2012. However, there have been disputes between large-scale retailers and local governments, as large-scale retailers filed lawsuits regarding the unfairness of the policy. Thus, the policy was repeatedly implemented, and then blocked depending on the region. Therefore, the start date of the Sunday shopping restriction policy is different in each region. In most regions, the policy was implemented

[2] cities, counties, and districts

in early 2014. As most of local governments order large retail stores to close on the second and fourth Sundays of each month, we refer to this as the Sunday shopping restriction throughout the paper.[3] [4]

As mentioned above, the main purpose of this Sunday shopping restriction is to protect small- and medium-sized retailers and traditional markets. The number of small- and medium-sized supermarkets and traditional markets began to decline when superstores and SSMs entered and dominated the local grocery market. To protect small and medium-sized retailers from being pushed out, the government implemented the Sunday shopping restriction policy. This government policy does not provide direct support to small retailers, but indirect support, by restricting the operation of competing superstores and SSMs. In this sense, the Sunday shopping restriction policy is expected to divert consumers from superstores and SSMs to small- and medium-sized supermarkets and traditional markets when superstores and SSMs are closed. Therefore, it is important to understand the effectiveness of this indirect policy, and to measure its impact on welfare of small- and medium-sized retailers and traditional markets. However, the effectiveness of the policy still have been much-discussed.

[3] Choi and Jeong (2016)

[4] Some regions set the second and fourth Wednesday or other days of each month as mandated days of closing.

2.2 Debates on the Effectiveness of the Regulation

There have been many controversies since Sunday shopping restriction policy was implemented. As small- and medium-sized retailers and traditional markets face such strong competition from superstores and SSMs, some argue that it is necessary to prevent large retailers from dominating the retail market. They argue that it protects and revitalizes small- and medium-sized retailers and traditional markets. Further, they contend that the current regulations are not sufficient to protect traditional markets and ask for the stronger regulation on large retailers.[5] On the other hand, others doubt the effectiveness of the regulation. They point out that consumers' choices may be limited due to the regulation, which may decrease consumer welfare. In addition, they argue that there could be negative impacts on the market, such as decreases in market efficiency, declining employment in a large retail sector. The key to this controversy is whether the Sunday shopping restriction is effective in protecting small and medium-sized retailers. In other words, the point is whether this regulation actually drives consumers to small and medium-sized retail stores, and if so, whether this transfer is economically sufficient for the sales of small and medium retailers.

[5]For instance, an increase in the number of mandated days of closing, or an expansion of scope of regulation target to other types of large retail businesses, such as large shopping complexes, department stores, warehouse-type supermarkets, agro-fishery supermarkets, etc., are currently discussed at the National Assembly.

In the next section, we summarize the previous researches about the impact of the Sunday shopping restriction policy.

3 Literature Review

Because the regulations on shopping hour or shopping day have been implemented in many other countries, many previous studies have analyzed the effect of the regulations. However, unlike Korea, which was implemented for the protection of small businesses, most countries implemented for reasons of religion and protection of employees. So, there have been many researches from this point of view. The IFP Institute (1995) analyzed the employment effects of mandated days of closing in Germany. Goos (2004) compared the employment and sales of affected industries and non-affected industries with US business ban on Sunday.

Many countries have been abolishing such regulations on business on Sundays due to its ineffectiveness. Along with this tendency of deregulation, many research has investigated the effect of deregulation. Morisson and Newman (1983) reported that sales of small retail stores were transferred to large retailers due to the abolishment of business hours restrictions in Vancouver, Canada. Skuterud (2005) showed the effect of Canada's deregulation on Sunday's business restrictions. Using different time of deregulation by region, they analyzed whether there are any differences in the employment and business hours, and whether they are open on Sundays. In Kajalo (2003), they showed that the increase in sales of large retailers and small retailers was differenti-

ated by the abolishment of the Sunday business regulations in Finland.

There also have been much research on the Sunday shopping Restriction in Korea. Most of the previous studies in Korea empirically analyzed the effect of the regulation. Those studies have investigated the effects of policy on various sectors using various data, such as supply side and demand side.[6] Most of researches about the supply side focus on the welfare effect of the regulation on the retail stores. (Choi and Jeong (2016), Kwon (2016), Jung (2015), Lee and Kwon (2014), Shin (2014), Kang et al. (2016), Kim (2012) etc.) On the other side, previous literature studies on the demand side, such as consumer welfare. However, there is not much research on this issue due to lack of data. Most studies relied on survey data collected from small retailers and consumers.[7] Some previous studies have analyzed the externalities that are not mainly discussed in terms of supply and demand. (Kim and Ryu (2013))

The impact of the regulation was evaluated differently in each research. Some studies suggest that there is no significant effectiveness of the policy. Choi and Jeong (2016) used the daily sales data of

[6] Jeong(2018) divided the topics that previous research study on into two sides, namely supply side and demand side.

[7] In order to measure the impact of the policy on consumer welfare, Choi and Jeong (2016) measured the compensating variation (CV) based on the estimated amount of spending transferred to small- and medium-sized retailers. Consumers' switching rate from superstores to small- and medium-sized retailers was calculated based on survey data from small and medium retailers.

large-scaled supermarkets and SSMs to estimate sales decrease in the large-scaled retail sector. They suggested only about 17% - 19% of the reduced sales are transferred to traditional markets. Lee and Kwon (2014) showed that the regulation of superstores reduces superstores' sales, but do not have positive impact on the sales in small-sized retailers. Kang et al. (2016) analyzed changes in spending on agri-food due to the Sunday shopping restriction. They showed that consumers' agri-food expenditure were not significantly different between in superstores and smaller retailers after the enforcement of the Sunday shopping restriction.

On the other hand, Kim (2012) showed that there had been increase in sales and the number of visitors on the closed Sunday based on the survey asked to merchants in traditional markets. Shin (2014) surveyed 1,000 small- and medium- sized retailers and 600 consumers. In the survey, half of the small- and medium- sized retailers answered that there was sales increase after the enforcement of the policy. Jung (2015) analyzed daily sales data of medium-sized supermarkets and traditional markets in Seoul and suggested that there was about 18% increase in sales on the closed Sunday compared to the ordinary Sunday.

4 Theoretical Framework

In this section, a simplified theoretical model is used to predict alternative choices when consumers are restricted in retail choices due to the Sunday shopping restriction. The model shows what type of alternative choices are made when consumers cannot visit large supermarkets and SSMs on certain days, and what factors create such alternative choices.

We define S as the chose set of types of retail stores that consumers can choose, and T as the choice set of days of the week that consumers can choose. Then a consumer's choice set A is defined as follows:

$$A = \{(s,t)|(s,t) \in S \times T\}.$$

Under set A, consumer i's utility maximization problem is defined as follows:

$$\max_{(s,t)\in A} U_i(s,t) - C_i(s,t)$$
$$s.t.\ C_i(s,t) \leq \overline{C_i},$$

where $U_i(\cdot)$ is consumer i's utility function for choosing a type of retail store, s, and the shopping day, t, and $C_i(\cdot)$ is the cost function for choosing the type of retail store, s, and the shopping day, t. $\overline{C_i}$ is the maximum level of cost (or effort) that consumer i can afford.

In this utility maximization problem, we assume that consumer i 's utility is maximized at (s^*,t^*):

$$i.e,\ U_i(s^*, t^*)\ >\ U_i(s', t'),\ \forall (s', t') \in S \times T.$$

What would be consumer i's alternative choice if (s^*, t^*) were not available in consumer choice set A? Consumer i's utility maximization problem is modified as follows:

$$\max_{(s,t)\in A'} U_i(s,t) - C_i(s,t)$$
$$s.t.\ C_i(s,t) \leq \overline{C_i}$$
$$where\ A' = A \backslash (s^*, t^*).$$

Under the modified utility maximization problem, consumer i, whose utility maximized choice was (s^*, t^*), can change his or her choice to three different alternatives:

i) Choose (s^*, t') $\Leftrightarrow$ $(s^*, t') \succ_i (s', t^*)$ *and* $(s^*, t') \succ_i (s', t')$
For consumer i to choose (s^*, t') means that following two conditions are satisfied:
$i) - (1)$ $U_i(s^*, t') - C_i(s^*, t')\ >\ U_i(s', t^*) - C_i(s', t^*)$

Subtracting $U_i(s^*, t^*) - C_i(s^*, t^*)$ from both sides,

$$\begin{aligned} \Leftrightarrow & \underbrace{[U_i(s^*, t') - U_i(s^*, t^*)]}_{①} - \underbrace{[C_i(s^*, t') - C_i(s^*, t^*)]}_{②} \\ > & \underbrace{[U_i(s', t^*) - U_i(s^*, t^*)]}_{③} - \underbrace{[C_i(s', t^*) - C_i(s^*, t^*)]}_{④} \end{aligned} \tag{4.1}$$

① Changes in utility by changing the day from t^* to t', where the type of retail store is fixed at s^* (marginal utility, $MU_{t|s^*}$).

② Changes in cost by changing the day from t^* to t', where the type of retail store is fixed at s^* (marginal cost, $MC_{t|s^*}$).

③ Changes in utility by changing the type of retail store from s^* to s', where the day is fixed at t^* (marginal utility, $MU_{s|t^*}$).

④ Changes in cost by changing the type of retail store from s^* to s', where the day is fixed at t^* (marginal cost, $MC_{s|t^*}$).

① + ② : Total changes in utility, $U_i(\cdot) - C_i(\cdot)$, by deviating from the optimum (s^*, t^*) to (s^*, t').

③ + ④ : Total changes in utility, $U_i(\cdot) - C_i(\cdot)$, by deviating from the optimum (s^*, t^*) to (s', t^*).

The difference between the marginal utility and the marginal cost is always negative by assumption when deviating from optimum (s^*, t^*) to any other choices. Therefore, both sides of Equation 4.1 are negative. Consumer i chooses (s^*, t'), which gives fewer changes in $U_i(\cdot) - C_i(\cdot)$, by comparing ① + ② to ③ + ④. In other words, consumer i

chooses (s^*, t'), which gives an lower absolute value in the difference between the marginal utility and the marginal cost.

$$i) - (2) \quad U_i(s^*, t') - C_i(s^*, t') \; > \; U_i(s', t') - C_i(s', t')$$

$$\Leftrightarrow \; U_i(s^*, t') - U_i(s', t') \; > \; C_i(s^*, t') - C_i(s', t')$$

$$\Leftrightarrow \; \underbrace{U_i(s', t') - U_i(s^*, t')}_{\text{ⓐ}} \; < \; \underbrace{C_i(s', t') - C_i(s^*, t')}_{\text{ⓑ}} \tag{4.2}$$

ⓐ Changes in utility by changing the type of retail store from s^* to s', where the day is fixed at t' (marginal utility, $MU_{s|t'}$).
ⓑ Changes in cost by changing the type of retail store from s^* to s', where the day is fixed at t' (marginal cost, $MC_{s|t'}$).
Holding the shopping day fixed at t', consumer i chooses (s^*, t') when the changes in utility by choosing s' are larger than the changes in cost by choosing s'. When the two conditions above are satisfied, consumer i changes his or her choice of day from t^* to t', while holding the choice of type of retail store at s^*; i.e., (s^*, t').

$$ii) \text{ Choose } (s', t^*) \; \Leftrightarrow \; (s', t^*) \succ_i (s^*, t') \; and \; (s', t^*) \succ_i (s', t')$$

$$ii) - (1) \quad U_i(s', t^*) - C_i(s', t^*) \; > \; U_i(s^*, t') - C_i(s^*, t')$$

This is the case in which the inequality of Equation (4.1) is reversed. If the following relations are satisfied in Equation (4.1), then consumer i chooses (s', t^*), which gives less deviation from the optimal

$U_i(s^*, t^*) - C_i(s^*, t^*)$:

$$① \ + \ ② \ < \ ③ \ + \ ④$$

$ii) - (2) \quad U_i(s', t^*) - C_i(s', t^*) \ > \ U_i(s', t') - C_i(s', t')$

$$\Leftrightarrow \ U_i(s', t^{*\prime}) - U_i(s', t') \ > \ C_i(s', t^*) - C_i(s', t')$$

$$\Leftrightarrow \ \underbrace{U_i(s', t') - U_i(s', t^*)}_{ⓒ} \ < \ \underbrace{C_i(s', t') - C_i(s', t^*)}_{ⓓ} \qquad (4.3)$$

ⓒ Changes in utility by changing the day from t^* to t', where the type of retail store is fixed at s' (marginal utility, $MU_{t|s'}$).
ⓓ Changes in cost by changing the day from t^* to t', where the type of retail store is fixed at s' (marginal cost, $MC_{t|s'}$).

Holding the type of retail store fixed at s', consumer i chooses (s', t^*) when the changes in utility by choosing t' are larger than the changes in cost by choosing t'. When the two conditions above are satisfied, consumer i changes his or her choice of type of retail store from s^* to s', while holding the choice of day at t^*; i.e., (s', t^*).

$iii)$ Choose $(s', t') \ \Leftrightarrow \ (s', t') \succ_i (s^*, t')$ *and* $(s', t') \succ_i (s', t^*)$
$iii) - (1) \quad U_i(s', t') - C_i(s', t') \ > \ U_i(s^*, t') - C_i(s^*, t')$

This is the case in which the inequality of Equation (4.2) is re-

versed. If the following relations are satisfied in Equation (4.2), then consumer i chooses (s', t'):

$$ⓐ > ⓑ$$

$$iii) - (2) \quad U_i(s', t') - C_i(s', t') > U_i(s', t^*) - C_i(s', t^*)$$

This is the case in which the inequality of Equation (4.3) is reversed. If the following relations are satisfied in Equation (4.3), then consumer i chooses (s', t'):

$$ⓒ > ⓓ$$

Therefore, if the preferred choice (s^*, t^*) is not available in consumer i's choice set, then consumer i's alternative choices are as follows;

i) (s^*, t'): switching the shopping day while maintaining the same type of retail store,
ii) (s', t^*): switching the type of retail store while maintaining the same shopping day,
iii) (s', t'): switching both type of retail store and day of shopping.

In this paper, the first alternative choice is called "Inter-temporal Substitution", the second alternative choice is called "Spatial Substi-

tution", and the third alternative choice is called "Other option".[8] This paper presents empirical evidence that these three consumer alternatives, predicted by the theoretical model, actually exist.

[8]Lee et al. (2009) proposed a similar theoretical model to this paper, but suggested three alternatives: 1) switching to retail stores, 2) switching shopping time, and 3) contraction of consumption.

5 The Data

5.1 Consumer Panel Survey Data

This paper mainly uses a Korean consumer panel survey data collected by the RDA. The data provides all agri-food expenditures for the participating households, and identifies the date and the type of the retail store where each purchase was made. The data also provides demographic information for each household, such as age, income range, household size, household composition etc. The data covers 8 years, from 2010 to 2017. Because for the first 5 years, the survey was conducted only in a metropolitan area including Seoul, Gyeonggi-do and Incheon, a panel dataset for 641 households in the metropolitan area from 2010 to 2017 were used in the analysis. These households submitted their expenditure records in good faith over 10 months in a year.

Table 5.1: Distribution of Households by Region and Year

Year / Region	Gyeonggi-do	Seoul	Incheon	Total
2010	261	274	65	600
2011	261	274	65	600
2012	267	260	66	593
2013	266	248	69	583
2014	264	247	70	581
2015	239	247	68	554
2016	192	248	68	508
2017	191	245	68	504
Total	1,941	2,043	539	4,523

In this paper, the analysis is conducted only for households in areas in the metropolitan area where the mandated day of closing is Sunday. The total number of unique households living in these areas is 604, which is the 94.2% of the total households in the total dataset. Distribution of households by region and year based on the Korean consumer panel is presented in Table 5.1 The highest number of households lives in Seoul, and the second highest number of households lives in Gyeonggi-do. Summary statistics for demographic variables of each household, as of 2017, are presented in Table 5.2. The average age of respondents is 50, and the average number of family members in each household is about 3 in 2017. According to the income distribution described in Table 5.2, over 45% of the total households earns more than 5 millions Won, which is because that most of households in the sample are middle-aged and live in metropolitan areas.

For the month that include New Year's Day and Chuseok[9], the local government can change the mandated day of closing at its discretion; therefore, we excluded all months including New Year's Day and Chuseok from all years. We also used store names to identify the location of the store, and then excluded from the sample the days that households shopped at superstores and SSMs in areas other than the household's area of residence.

[9]One of the Korean traditional holidays in Fall, which is similar to Thanksgiving day in western countries.

Table 5.2: Summary Statistics for Demographic Variables (in 2017)

Variable		Obs.	Mean	Std. Dev.	Min	Max
Age of Respondent		504	50.52	8.40	31	72
Number of Family Members		504	3.33	1.13	1	8
Groups of Annual Household Income (Thousand Won)	<2,000	504	0.06	0.23	0	1
	2,000∼2,490	504	0.04	0.20	0	1
	2,500∼2,990	504	0.05	0.22	0	1
	3,000∼3,490	504	0.13	0.33	0	1
	3,500∼3,990	504	0.08	0.27	0	1
	4,000∼4,490	504	0.09	0.29	0	1
	4,500∼4,990	504	0.08	0.27	0	1
	5,000∼5,990	504	0.17	0.38	0	1
	6,000∼6,990	504	0.11	0.31	0	1
	>7,000	504	0.19	0.39	0	1

The retail stores that consumers visit are divided into eight types in the data. In this paper, we focus on four types of retail stores which are most frequently visited among the eight retail types.[10] Table 5.3 shows the distribution of expenditure records for the four major types of retailers, namely superstores, SSMs, small and medium supermarkets,[11] and traditional markets. A total of 495,444 expenditure records were used in the analysis, with the highest number of records for small- and medium-sized supermarkets.

[10]Superstore, SSM, Small and Medium Supermarket, Traditional Market, Department store, Convenience store, Online shopping, Specialty store

[11]including supermarkets operated by private operators and franchise supermarkets

Table 5.3: Number of Purchase Records by Major Types of Retailers

	Superstore	SSM	Small and Medium Supermarket	Traditional Market	Total
Obs.	55,550	49,655	260,535	120,796	495,444

5.2 Regulatory Data

Since the Sunday shopping restriction policy was implemented differently in each region, the date of enforcement and the mandated day of closing differs. We collected the information on the date of enforcement and the mandated day of closing in each region. Of the 66 local governments in Seoul, Incheon, and Gyeonggi-do provinces, which are the metropolitan areas, there were 53 areas for which detailed information on the regulation was available. Table 5.4 shows when the 53 regions implemented the Sunday shopping restriction policy. This policy began in some areas in 2012, and was implemented in most of the areas in 2016. As shown in Table 5.5, most areas have designated the second and fourth Sundays of the month as mandated days of closing, and the second and fourth Wednesdays are designated as mandated days of closing in some areas of Gyeonggi-do Province. Five counties in Gyeonggi-do province designated the second and the fourth Sundays as mandated days of closing at the beginning of the enforcement of the policy, but changed to Wednesday after 1 to 2 years. As described previously, in this paper, we analyze only households in regions in which the mandated day of closing is a Sunday.

Table 5.4: Number of areas in the Sample That Enacted the Policy

Year	2010	2011	2012	2013	2014	2015	2016	2017
Number of areas (Cumulative)	0	0	16	41	49	52	53	53

Table 5.5: Mandatory Closing Day by Region

Region \ Restricted Day	Wednesday	Sunday	Total
Gyeonggi-do	10	12	22
Seoul	0	25	25
Incheon	0	6	6
Total	10	43	53

5.3 Sales Data from Local Supermarkets

In this paper, we also use the real sales data from POS systems of small-and medium-sized supermarkets in Gyeonggi-do, which are not regulated under the Sunday shopping restriction policy. Daily sales and the number of visitor , etc., of four small and medium-sized supermarkets in Gyeonggi-do are used for analysis. These four supermarkets are located in different cities in Gyeonggi-do. Table 5.6 shows information about the four supermarkets. We label the four supermarkets as A, B, C, and D to mask the identity of the supermarkets and regions. The data collected from each supermarket covers different periods in the sample. All supermarkets provided data only after the enforcement of the regulation. Thus we cannot trace the records before the enforcement of the regulation. Since the four supermarkets are located in different cities, their mandated days of closing are different. One su-

permarket experienced a change in the mandated days of closing. Two of the four supermarkets have five-day markets in their neighborhood. In other words, the five-day market opens near the supermarkets every five days in those regions. The days when the five-day markets are open are listed in Table 5.6.

Table 5.6: Data from Four Different Local Supermarkets

	Data Period	Mandated Closing Day	No. of Regulated Stores in Neighborhood	Five-Day Market Opening
A	2015.08.01-2017.05.29	Sunday (2nd,4th)	2	4, 9, 14, 19, 24, 29
B	2013.12.23-2017.06.12	Sunday (2nd,4th) Wednesday (2nd,4th)*	3	
C	2015.07.01-2017.06.15	Wednesday (2nd,4th)	2	3, 8, 13, 18 23, 28
D	2014.03.01-2017.01.31	Sunday (2nd,4th)	2	

Note: The region in which supermarket B is located changed the mandated closing day from Sunday to Wednesday since December 2014.

6 Evaluation on The Impact of the Regulation

In this section, we investigate consumers' behavior changes due to the Sunday shopping restriction. We empirically analyze the alternative choices of consumers who cannot visit superstore and SSMs on the mandated closing Sundays. We empirically test the three types of alternative choices predicted by the theoretical framework. In other words, we figure out whether consumers who favor superstores and SSMs show the "Inter-temporal substitution" of visiting superstores and SSMs on other days due to the regulation, or whether they show the "Spatial substitution" of visiting other types of retail stores on the closed Sundays. For this purpose, we focus on changes in consumers' choice on days and types of retail stores, rather than those in expenditure, which is distinct from previous literature.

6.1 Sample Description

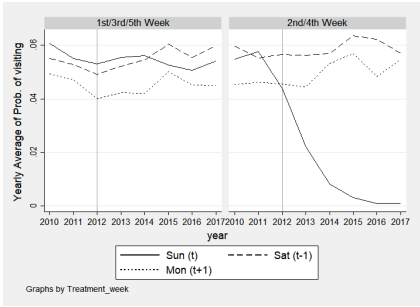
We transform the 2010 - 2017 consumer panel data provided by the RDA to analyze the consumers' choice of shopping days and places. The consumer panel data is a kind of scanner data that collects the receipts of each household's food expenditure. The unit of raw data is a single purchase of an individual household. To convert the data into a form that is easy to analyze, the purchase history data was aggregated by household, date, and type of retail stores. Through this

work, the original data in the form of scanner data was converted into panel data for each household's daily choice on retail stores. That is, a unit of the transformed data has all the information about an individual household's daily purchases. Whether they purchase agri-food products, which types of retail stores they visit, and how much they spend on agri-food products, etc. are summarized in the final dataset. In addition, the regulatory data[12] of each local governments was combined and used to identify the regulated period in each region.

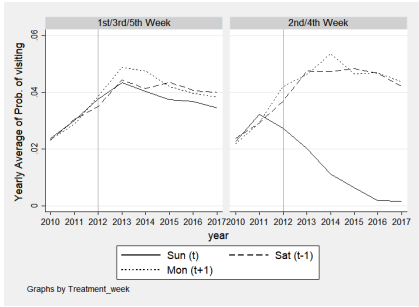
Before the analysis, we examine the preliminary results through descriptive statistics to see whether consumers actually changed their purchase behavior due to the regulation. Figure 6.1 shows the annual trend of the proportion of the households visiting each type of retail stores. The beginning of the implementation of the regulation is marked by a vertical line in 2012. The visit rate was separately calculated for weeks including the first, third, and fifth Sundays and for weeks including the second and fourth Sundays. For the right comparison, we limited the sample to the households surveyed in all sample periods, for these graphs. The solid line represents the visit rate for Sundays, the broad dotted line represents the visit rate for Saturdays, and the narrow dotted line represents the visit rate for Mondays.

Figure 6.1 (A) shows the trend for the visit rate for superstores. Examining the first, third, and fifth Sundays, not the closing Sundays,

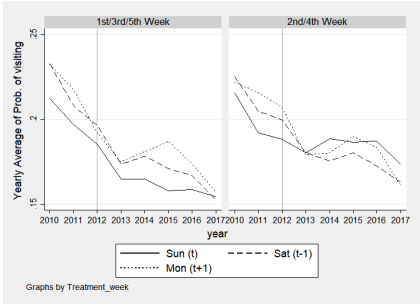
[12] self-collected data, which is explained in the previous section



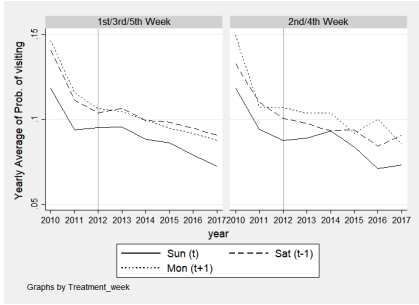
(A) Superstore



(B) SSM



(C) Small & Medium Supermarket



(D) Traditional Market

Figure 6.1: Trends in Visit probability

and the day before and after the Sunday, there is no considerable difference between before and after the implementation of the regulation. However, for the second and fourth Sundays, the closing Sundays, the visit rate gradually decreases from 2012, when the policy was implemented. This is a natural consequence of an increase in the number of stores closing due to the regulation. The visit rate on Saturday and Monday is increasing, while the Sunday visit rate is decreasing after the implementation of the regulation on the first, third, and fifth week. This shows that some of consumers who could not visit superstores on the closing Sunday switched their shopping day to the day before or

the day after the closing Sunday.

The effect of the policy is more pronounced in the SSM visit rate trend. Figure 6.1 (B) shows that visit rate for SSMs surged from 2010 to 2013. This is because the number of newly opened SSMs has increased sharply during this period. These temporal characteristics appear to be independent of the week. The SSM visit rate for the second and fourth Sundays is also drastically reduced, similar to that of the superstores, while at the same time, the visit rates for Saturday and Monday increase. This means that if consumers cannot visit SSMs on the mandated closing Sunday, they visit SSMs on Saturday or Monday.

As shown in Figure 6.1 (C), for small- and medium-sized supermarkets, visit rate for Sunday is lower than that of other days before the policy was implemented. As time passes, the visit rate tended to gradually decrease. However, after the policy was implemented in 2012, it seems that the visit rates for the second and fourth Sundays are higher than those for other days. As a result, we conclude that some consumers visit small- and medium-sized supermarkets on the day that superstores and SSMs are not allowed to open.

There is no such trend for traditional markets due to the Sunday shopping restriction as in Figure 6.1 (D). Similar to small- and medium-sized supermarkets, traditional markets show a decreasing

visit rate. It can be inferred that the policy has a positive effect on small- and medium-sized supermarkets, but not on traditional markets. Through the four graphs, we can infer that consumers' behavior would not have changed if it were not for the policy. This can be confirmed by the fact that the week without a closing Sunday does not show a considerable change in visit rate between before and after the policy was implemented.

6.2 Empirical Strategy

We use a difference-in-differences approach to estimate the net policy effect. To identify the net effect of the policy, properly selected treatment and control groups are required to correct for the endogeneity of the market. Many previous studies also attempted to identify the effects of the policy using difference-in-differences by looking for appropriate treatment groups and control groups. Kang et al. (2016) and Jung and Lee (2017) divided the treatment group and the control group according to whether the retail stores were regulated or not. Korea Legislation Research Institute (2017) used consumers' purchasing histories and location information of retail stores to distinguish consumer groups affected by regulation. In this paper, we consider the time trend because we are analyzing the mid-term effect using the data from 2010 to 2017, rather than the early stage of implementation as in previous studies. The following factors can induce bias via a time ef-

fect: 1) the entry and exit of superstores and SSMs, [13] 2) the decline of small- and mid-sized supermarkets and traditional markets, and 3) the growth of Internet shopping. Therefore, it is important to set an appropriate treatment group and control group, to meet the assumption that time effects do not change systematically between the treatment group and the control group. However, because the time effects discussed above are likely to be differentiated between the two groups from the medium-term perspective, the approaches used in previous studies have limitations in identifying the effects of the policy.

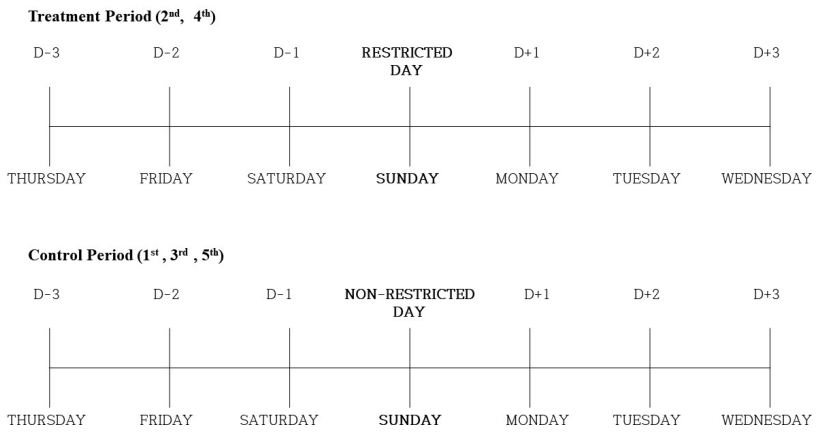


Figure 6.2: Definition of the Treatment and Control Periods

As Figure 6.1 shows, there was a sharp increase in the entry of SSMs in the market from 2011 to 2013. To control for this time trend,

[13] Figure A.5 and Figure A.6 in the Appendix show the entry and exit trends of Superstores and SSMs

we set up a treatment group and a control group, which are considered to have no difference in time trend. The treatment group and the control group used in this paper do not distinguish between the retail type or the consumer type. In this paper, we classify the samples into affected and non-affected weeks by the Sunday shopping restriction policy based on date. The definition of the treatment period and the control period are illustrated in Figure 6.2. Because the analysis target area is limited to areas in which the mandated days of closing are the second and fourth Sundays, the restricted day exists only in the second and fourth weeks in the sample. Thus, the seven-day period including the three days before and after the second or fourth Sunday is defined as the period affected by the policy, and is referred to as the "Treatment Period". A non-closed Sunday is referred to as the non-restricted day in the figure, and the seven-day period, including the three days before and after the no-restricted day, is defined as the "Control Period". In other words, if the second or fourth Sunday of each month is a restricted day, then the period of treatment is from the second Thursday, which is three days before the second or fourth Sunday, to Wednesday, which is three days after the restricted day. As the first, third, and fifth Sundays are normal business days, the period from Thursday, which is three days before the day, to Wednesday, which is three days after the day, can be called the control period. Therefore, two treatment periods and two control periods exist in one month. If the time-specific effects do not change systemically by week,

then the defined treatment groups and control groups can be expected to fully satisfy the parallel shift assumption, which is the most important assumption for using difference-in-differences, because it is less likely that there are systematical differences in consumers' purchasing behavior between the two periods when there is no such regulation. This is also shown in Figure 6.1.

A fixed-effect panel regression model is used to control each household's fixed effect. It is expressed as Equation (6.1)

$$\begin{aligned} y_{it} = \alpha + \beta Treat_t + \gamma Post_{it} + \delta(Treat_t \times Post_{it}) \\ +\theta' X_{it} + \phi_t + \eta_i + \epsilon_{it}. \\ \text{where } \alpha = a_{-3}D_{-3} + \cdots + a_0 D_0 + \cdots + a_{+3}D_{+3} \\ \beta = b_{-3}D_{-3} + \cdots + b_0 D_0 + \cdots + b_{+3}D_{+3} \\ \gamma = c_{-3}D_{-3} + \cdots + c_0 D_0 + \cdots + c_{+3}D_{+3} \\ \delta = d_{-3}D_{-3} + \cdots + d_0 D_0 + \cdots + d_{+3}D_{+3}, \end{aligned} \tag{6.1}$$

where y_{it} is a dummy variable indicating whether i visits a type of retail stores, j, on date t, X_{it} is a vector of the household's demographic variables, such as the number of family member, income, region etc; ϕ_t is a vector of the time effects, and including year dummy variables, month dummy variables, and national holiday dummy variable, and η_i is a household-specific effects. $Treat_t$ is the dummy variable indicating if date t is included in the treatment period, $Post_{it}$ is the dummy variable indicating if the region where household i resides is

under the restriction policy on date t. The variable of interest is the interaction term of two dummy variables, $Treat_t \times Post_{it}$. The average change in the dependent variable due to the treatment is captured by $(\gamma - \delta) - (\alpha - \beta)$. This captures the effect after the enforcement of the policy by estimating whether the difference between the second and fourth weeks and the rest of the week has changed since the implementation. The restricted Sunday can cause different effects for different days of the week when consumers change the shopping days when they visit retail stores. To reflect this in the model, we set the coefficients of the variables of interest as functions of the day of week dummy variables. In Equation (6.1), D_j is a dummy variable representing the day when j days have passed since Sunday. If it is Sunday, $j = 0$. The discriminatory effect of each day of week is captured by $(c_j - d_j) - (a_j - b_j)$. This is the effect of the policy on the days of the week that are j days away from the restricted Sunday. Depending on the dependent variable, this model can exhibit either inter-temporal substitution or spatial substitution. If the dependent variable is a dummy variable that indicates whether a superstore or SSM was visited, the estimated coefficient implies inter-temporal substitution. If the dependent variable is a dummy variable indicating whether a small- and medium-sized supermarket or traditional market was visited, the estimated coefficient implies spatial substitution.

6.3 Estimation Results

In this section, the estimation results of Equation (6.1) are presented as a graph. The bar graph represents the difference-in-differences coefficient estimate for each day of the week, and the vertical line at the end of bar chart represents the 95% confidence interval. The the coefficient can be interpreted as how much percentage point(% P) in the visit probability increases on the corresponding day of the treatment period compared to the control period. If the 95% confidence interval includes 0, the null hypothesis that the effect of the policy is zero is not rejected; thus it is judged that it is not statistically significant. Figure 6.3 shows the results of the analysis of the probability of superstore and SSM visits. For the convenience of interpretation, only the changes on Sunday, Saturday, and Monday are shown in the graph. Estimation results for the entire day are presented in the appendix.

In the case of superstores, it is estimated that the visit probability increases on the Monday of the treatment period compared to the Monday of the control period. In the case of SSMs, it is estimated that the visit probability increases on the Saturday and the Monday of the treatment period. As a result, it is concluded that when consumers are restricted from visiting superstores on a Sunday, they change their shopping day to the next day, Monday. In addition, the SSMs showed inter-temporal substitution to the day before and after the restricted

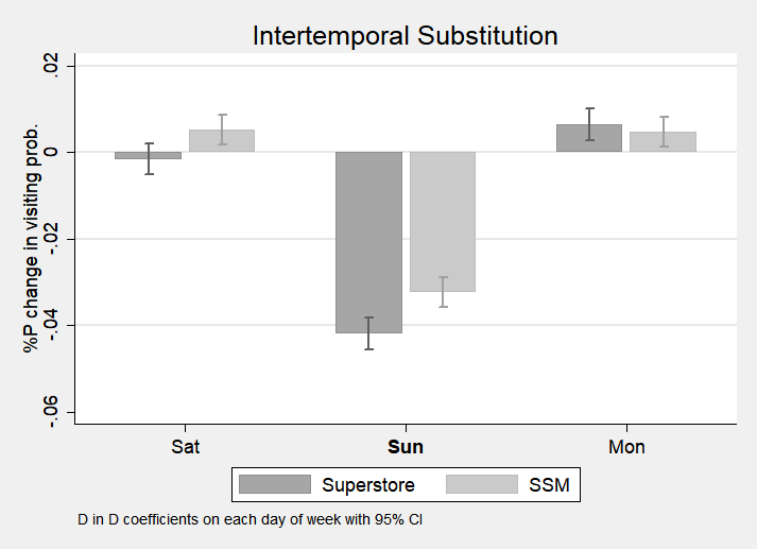


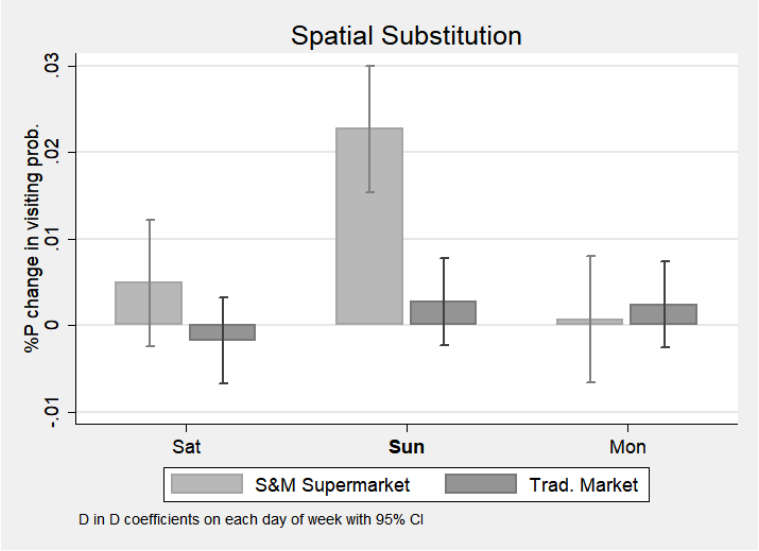
Figure 6.3: Inter-temporal Substitution

Sunday.[14] This result is consistent with previous studies that showed SSM visitors are more likely to show inter-temporal substitution, because the switching cost is lower for SSMs than for superstores.[15]

Figure 6.4 shows the estimation result of setting whether to visit small- and medium-sized supermarkets and traditional markets as the dependent variable. The probability of visiting small- and medium-sized supermarkets is much higher on the treatment Sunday than on the Sunday of the control period. As a result, it can be confirmed that consumers who cannot visit SSMs and superstores on the restricted

[14]There can be some consumers who switch their shopping days to the Sundays in the control periods. This substitution patterns can be defined as "Inter-week Substitution". This type of alternative choice is discussed later in the appendix.

[15]Choi and Jeong (2016)



Note: S&M Supermarket refers to a small- and medium-sized supermarket.

Figure 6.4: Spatial Substitution

Sunday show spatial substitution with small- and medium-sized supermarkets. However, this pattern of increases does not appear for traditional markets. In addition, no statistically significant increase is observed for other days.[16] Table 6.1 shows the percentage changes in the probability that consumers visit each type of retail stores. The percentage changes are calculated by dividing coefficients by the control mean. The control mean is the counterfactual visit probability of each day of the week, assuming that there is no Sunday shopping restriction. The magnitude shown in Table 6.1 is used for measuring the welfare effect of the policy in the next subsection.

[16]In addition to these two types of retail stores, there is a possibility of transferring to department stores or online shopping malls, but no statistically significant increase is observed.

Table 6.1: Percent Changes in Probability of Visit

Percent Change		Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday
Superstore	Coefficient	0.000	0.002	-0.001	-0.039	0.006	0.004	0.004
	Control mean	0.04	0.04	0.053	0.047	0.041	0.038	0.037
	Magnitude	-0.61%	5.25%	-2.20%	-81.89%	14.58%	9.89%	11.13%
SSM	Coefficient	0.000	-0.001	0.004	-0.029	0.005	-0.001	-0.001
	Control mean	0.03	0.032	0.031	0.026	0.032	0.031	0.032
	Magnitude	-1.35%	-2.71%	13.54%	-114.20%	15.60%	-2.82%	-1.60%
Small and Medium Supermarket	Coefficient	0.001	0.005	0.003	0.022	-0.001	-0.003	0.004
	Control mean	0.206	0.206	0.209	0.198	0.214	0.21	0.206
	Magnitude	0.46%	2.44%	1.38%	10.96%	-0.65%	-1.34%	1.95%
Traditional Market	Coefficient	0.001	0.003	-0.001	0.001	0.001	0.005	0.004
	Control mean	0.103	0.102	0.101	0.091	0.106	0.105	0.104
	Magnitude	1.14%	2.85%	-0.90%	0.82%	1.20%	4.42%	3.88%

6.4 Welfare Analysis

In this section, we evaluate the effectiveness of the Sunday shopping restriction policy. The policy is implemented to protect small- and medium-sized retailers, so it is necessary to understand how this policy has increased the sales of these retailers. In addition, this policy was not a direct support, but an indirect support, to shift consumers from large retailers to small- and medium-sized retailers by restricting competition. Therefore, it is important to understand how much consumers have actually transferred their consumption to small- and medium-sized retailers due to this policy. To do this, we used the increase and decrease in the visit probability per day calculated from Table 6.1. We also reflected the change in the average expenditure as the visitors composition changes.[17] The estimation results of the changes in spending due to the policy are included in the appendix. Using percentage changes in the daily visit probability, we estimated a decrease in the number of visitors to superstores and SSMs due to 24 restricted Sundays per year. This decreased number of visitors was multiplied by the average expenditure per person, which refers to a decrease in sales due to the 24 mandated closing Sundays per year. To find out how the sales reductions are transferred to the three alternatives predicted through the theoretical model, namely, inter-temporal substitution, spatial-substitution, and other options, we calculated an

[17] Equation (6.1) was estimated with the logarithm of expenditure as the dependent variable.

increase in the number of visitors to small- and medium-sized supermarkets and traditional markets on mandated closing Sundays and other days using percentage changes in the daily visit probability. The increased number of visitors was multiplied by the average expenditure per person to calculate the increase in sales on the restricted Sundays. Table 6.2 shows the summary statistics for the number of visitors and average expenditure per household for each type of retail store, which is used to measure the total changes in sales for each type of retail store. Because we used baseline data for 2017, we calculated the number of visitors and expenditure that retail stores would have had if there were no Sunday shopping restriction, and we used it to calculate transfers of sales resulting from the policy.

Table 6.2: Summary Statistics for the Retail Market (in 2017)

Based on 2017	Superstore[1]	SSM[2]	small- and medium-sized Supermarket[3]	Traditional Market[4]
Number of Stores (nationwide)	529	1,595	25,928	1,737
Daily Visitors per Store	4,920	897	1,170	4,553
Expenditure per Person (KRW)	42,535	14,516	15,753	11,256
Agri-Food Sales Ratio	57.9%	89.1%	92.3%	59.3%

Source: 1. Ministry of Commerce, Industry and Energy "Sales trends of major distributors": Superstore and SSM's sales per store, expenditure per person, sales ratio by category; 2. Small Business Corporation Promotion Corporation "Traditional Market, Shopping Market Management Survey": Traditional Market's Visits per Day, expenditure per person, Store composition Ratio; 3. small- and medium-sized supermarket (self-collected): Number of visitors per day, expenditure per person, portion of agricultural product expenditure (4 supermarkets in Gyeonggi-do only); 4. Korean Content Media "2017 Retail Industry": Number of stores nationwide by retail business

As shown in Figure 6.5, the total sales decrease of superstores

and SSMs is expected to be about 3.16 trillion won. However, 35% of the expected sales decrease was retained due to inter-temporal substitution to the days before and after the mandated closing Sunday. The transfer to small- and medium-sized supermarkets was estimated to be about 41%, and only 0.6% of the expected sales decrease was transferred to traditional markets. As a result of the analysis of the total sales, it can be seen that about 77% of the sales decrease is explained by inter-temporal substitution, spatial substitution, and other options. The unexplained part is thought to have been transferred to online shopping malls, department stores, convenience stores, etc. Because the data used in this paper includes only agricultural food expenditures, it is impossible to estimate the portion where non-food expenditures are transferred to other retail stores.

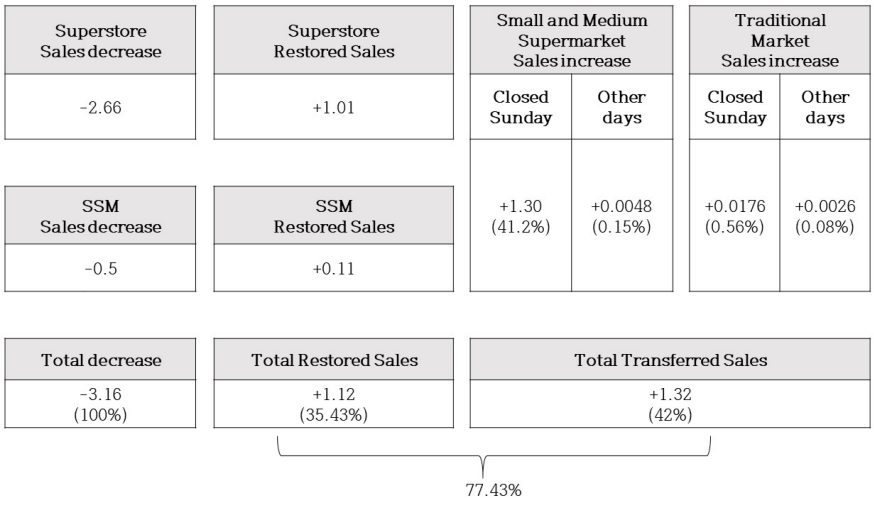


Figure 6.5: Estimated Transfers of Total Sales (Trillion Won)

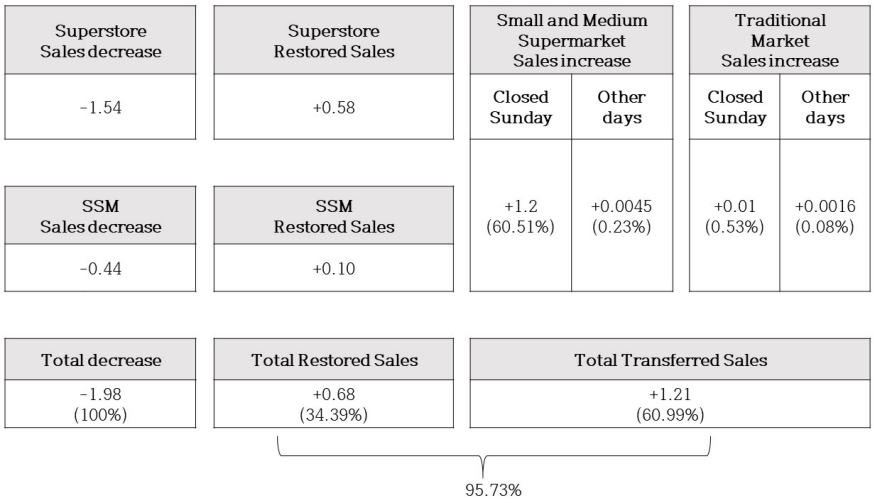


Figure 6.6: Estimated Transfers of Agri-food Sales (Trillion Won)

Figure 6.6 shows the welfare analysis results based on the sales of agri-food products, rather than the total sales. As a result of estimating that more than 90% of small- and medium-sized supermarket sales are agricultural products, the portion transferred from superstores and SSMs to small- and medium-sized supermarkets is estimated to be about 60%. However, less than 1% of decrease in the sales of agricultural products were transferred to traditional markets. Based on this, it can be seen that 95% of the decrease in the sales of agri-food products is explained by inter-temporal substitution, spatial substitution, and other options. As a result, our finding implies that the regulation transfers revenues from superstores and SSMs to small- and medium-sized supermarkets, but it does not significantly help traditional markets.

7 Consumers' Heterogeneous Responses to the Regulation

In this section, we examine the heterogeneous effect of the Sunday shopping restriction policy by consumer type. In other words, we investigate what types of consumers show inter-temporal substitution and what types of consumers show spatial substitution.

7.1 Sample Description

We aggregate the consumer panel data from the RDA used in the previous section in the household unit. The variables used for aggregation are how frequently each household visits each type of retail store in a month. To exclude the effect of the Sunday shopping restriction policy on the frequency of visits, the data collected before the implementation of the policy is used in aggregation .As the data is aggregated by household unit, the there is a total of 601 observations.[18] One observation has summarized information on the household's pattern of retail store visits. Table 7.1 shows the average number of purchases, or visits, per month by the type of retail store. Four types of retail stores are analyzed in this section. Small- and medium-sized supermarkets are most frequently visited with 6.34 visits per month on average , followed by traditional markets with 3.09 visits per month on average.

[18]Three households were excluded because of missing values.

Table 7.1: Average Number of Purchases per Month

	Superstore	SSM	Small and Medium Supermarket	Traditional Market
No. of Purchases per Month	1.78	1.06	6.34	3.09

7.2 Empirical Strategy

Clustering methodology is used to divide consumers into different groups with different purchase patterns. The clustering methodology distinguish consumers with similar characteristics based on the data. In this paper, K-means clustering methodology is used. This technique divides data into different K groups without overlapping. The points close to the K center points are gathered to form a cluster. At this time, the K center points are found as a result of learning repeatedly until each data point is close to the center of its cluster, and simultaneously distant from the center of the other clusters. In other words, K-means clustering is a technique for finding clusters and center points that minimize the within-cluster variation. The within-cluster variation can be calculated as the sum of the Euclidean distances between the center and each point in a cluster.

Before clustering, it is necessary to consider how to specify the number of clusters, K, in the analysis. To find out how many clusters is the optimal number for classifying the purchasing patterns, we check how the within-cluster variation varies with the number of clusters. The optimal number of clusters is determined based on the

explained variance that varies with the number of clusters. The explained variance is referred to as the sum of the variances within each cluster divided by the total variation. The closer to 1, the greater the portion of the variation within the cluster in the total variation, which means that the explanatory power of the separate cluster is low. As the number of clusters increases, the explained variance decreases. However, because the number of infinitely many clusters is meaningless, the optimal number of clusters is determined at a point where the explained variance decrease sufficiently. These points are called elbow points.

The clustering methodology has the advantage of being able to consider various criteria jointly, and to find the average consumer group and other outliers. However, K-means clustering is disadvantageous in that it cannot find the global optimum in the first trial. For this reason, we need to iterate several times while changing the initial value, and find the K center points that show the best performance. This iteration process applies equally to the optimal number of clusters. We iterate the entire estimation process for 5,000 times to find the most powerful clustering results.

7.3 Estimation Results

Figure 7.1 shows the iteration results for searching for the optimal number of clusters. The elbow point seems to be 5, where the decrease in the explained variance has slowed down. Therefore, the optimal number of clusters for the data is 5. The results of K-means clustering using the determined optimal number of clusters are shown in Table 7.2. 601 households are distributed in six clusters. The cluster with the largest number of households is cluster 5 with about 42% of households.

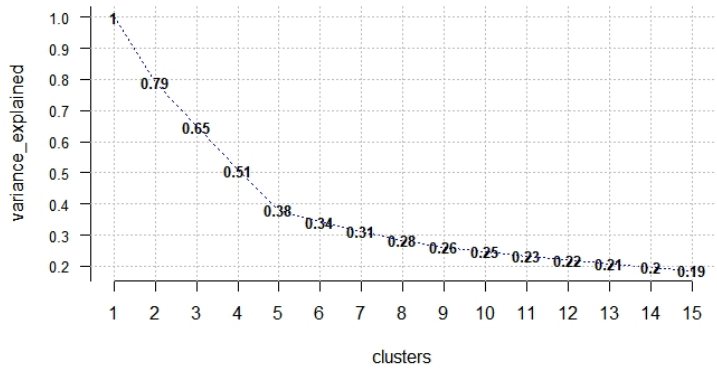


Figure 7.1: Optimal Number of Clusters

Table 7.3 shows that the average number of visits to each retail store by cluster. This summarizes the characteristics of each cluster. The characteristics of each cluster are shown prominently in Figure 7.2. Cluster 1 is the consumer group which mainly visits traditional markets, cluster 2 is the consumer group which mainly visits super-

Table 7.2: Clustering Results

Cluster	Obs.	Percent(%)	WCSS*
5	256.00	42.60	219.72
4	169.00	28.12	205.04
2	68.00	11.31	137.11
1	56.00	9.32	157.34
3	52.00	8.65	194.41
Total SS.**	2,400		
$R^2 = \frac{BetweenSS.}{TotalSS.}$	61.90%		

*WCSS: Within-Cluster-Sum-of-Squared Errors
**SS: Sum-of-Squared Errors

Table 7.3: Average Number of Visits by Cluster

Cluster No.	Percent(%)	Superstore	SSM	Small and Medium Supermarket	Traditional Market
5	42.60	1.24	0.58	3.94	1.97
4	28.12	1.14	0.53	11.12	2.49
2	11.31	6.06	0.66	3.79	1.52
1	9.32	1.11	0.84	6.75	13.20
3	8.65	1.68	5.92	5.57	1.65

stores, cluster 3 is the consumer group which uses SSMs most frequently, cluster 4 is the consumer group which uses small and medium supermarkets the most, cluster 5 is a group of consumers who visit several types of retail stores.

Then we examined whether the group of consumers separated by clustering responded heterogeneously to the Sunday shopping restriction policy. Table 7.4 summarizes the inter-temporal and spatial substitution patterns by cluster. The analysis shows that most consumers did not use only one type of retail store, but used various types of retail

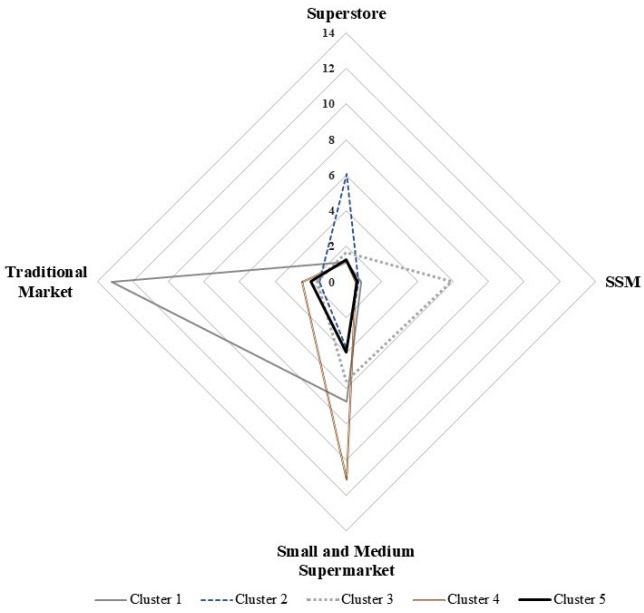


Figure 7.2: Most Frequently Visited Type of Retail Store

stores. It was confirmed that consumers who use various retail stores respond to the restriction policy the most. They even show the spatial substitution to traditional markets. These results suggest that consumers' experience of using traditional markets is an important factor for consumers to switch their shopping place to traditional markets. In addition, it was confirmed that customers who prefer SSMs and superstores, which are regulated by the Sunday shopping restriction policy, show spatial substitution to small and medium supermarkets due to the policy. Consumers who used traditional markets most frequently did not respond to the policy. Based on these results, it can be seen that the Sunday shopping restriction policy resulted in sufficient

consumer movement from superstores and SSMs to small and medium supermarkets.

Table 7.4: Heterogeneous Response by Cluster

Cluster			Inter-temporal Substitution		Spatial Substitution	
			Superstore	SSM	Small and Medium Supermarket	Traditional Market
Visitors Preferring Specific Type of Retailer	Traditional Market	1	7.99%	-5.14%	1.35%	-0.47%
	Superstore	2	5.57%	-3.30%	**14.85%**	-2.06%
	SSM	3	8.71%	**3.82%**	**33.54%**	6.40%
	Small and Medium Supermarket	4	**15.68%***	**33.48%***	**5.61%**	-1.69%
Complementary Visitors		5	**14.36%**	**5.86%**	**18.52%**	**15.14%**

Note: Each value means the percentage change.
Statistically significant estimates are written in bold.
*Consumers in the cluster 4 had the higher rate of visiting superstores and SSMs on Sunday than other clusters before the enforcement of the policy, shown in the Figure A.9 and Figure A.10.

The analysis of the heterogeneous purchasing behavior of consumers suggest that most consumers show complementary choice on retail store. The existence of these consumers means that the category of products that consumers purchase for each retail store is different. If there are many of this type of consumers, the effect of the regulation on large retailers will be differentiated by product categories, and thus, a detailed analysis on product categories is presented in the next section.

8 Heterogeneous Shopping Baskets in Each Type of Retail Store

In this section, we analyze whether consumers organize their shopping baskets differently for each type of retail stores. In other words, we compare the shopping baskets purchased in superstores and SSMs to those in small- and medium-sized supermarkets and traditional markets. To do this, we use two types of data: One is the RDA's consumer panel data, and the other is real sales data from four small- and medium-sized supermarkets in Gyeonggi-do.

8.1 Sample Description

We use purchase history data as it is from the consumer panel data. It means we analyze an individual purchase by a household as one observation. The product categories provided by the consumer panel are classified as processed foods, marine products, livestock products, vegetables, fruits, alcohol, and grains. In this analysis, these seven categories are reclassified into three categories for convenience of analysis. The three categories are defined to as long-term storable foods, fresh foods, and Frozen storage throughout the section. Long-term storable foods include processed foods, alcoholic beverages, and grains. Fresh foods include vegetables and fruits with a short shelf life. Frozen storage include livestock products and marine products. In this section, the sample data contains how much households spend on each product

category. In addition, we use daily sales data from small- and medium-sized supermarkets to back up the analysis with the RDA's consumer panel data. Because this data is collected for product categories, it has the advantage of being comparable to the product categories of the consumer panel data.

8.2 Empirical Strategy and Results

8.2.1 Big Data Analysis

To analyze the first data set, we use the clustering technique used in the previous analysis. However, the variable used for clustering is the expenditure for each of the three categories. The expenditure for each product category is converted into the ratio to the total expenditure. Because the similarity of the purchase records can be changed depend on the total amount of the expenditure, the total expenditure is added to the clustering variables, which are the expenditure ratio for the three product groups. Therefore, a total of four clustering variables are used for the analysis.

Figure 8.1 shows the iteration results for searching for the optimal number of clusters. The elbow point seems to be 4, where the decrease in the explained variance has slowed down. Therefore, the optimal number of clusters for the data is four. The results of K-means clustering using the determined optimal number of clusters are shown in Table 8.1. A total of 230,362 purchases are distributed in four clusters. The cluster with the largest number of households is cluster 4

with about 42% of the observations. The cluster with the smallest number, cluster 1, has approximately 6% of the observations.

Table 8.2 shows the average of each clustering variable by cluster. Cluster 4 consists of purchases with the largest portion of spending on long-term storable foods, 88% on average. Cluster 2 has the largest ratio of purchases of fresh foods, 85% on average, while Cluster 3 has the largest ratio of purchases of frozen storage, such as livestock products and marine products, 69% on average. Cluster 1 shows higher total spending than the other clusters, 78,084 won on average.

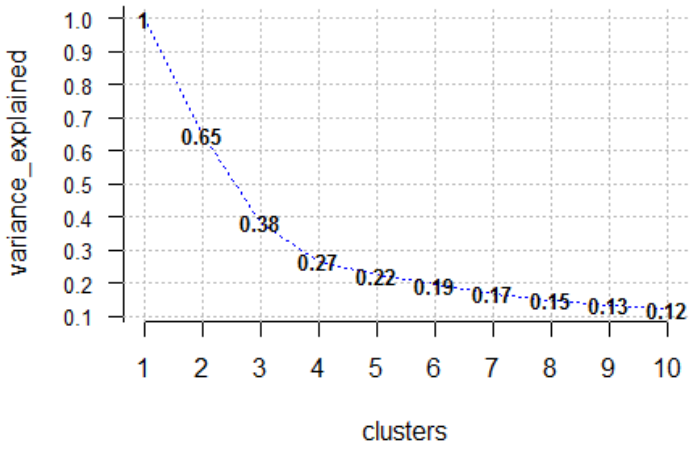


Figure 8.1: Optimal Number of Clusters

Table 8.1: Clustering Results

Cluster	Obs.	Percent(%)	WCSS*
4	97,566	42.35	61,716.71
3	65,943	28.63	49,587.14
1	53,006	23.01	63,689.01
2	13,847	6.01	70,110.07
Total SS.**		921,444	
$R^2 = \frac{BetweenSS.}{TotalSS.}$		73.4%	

*WCSS: Within-Cluster-Sum-of-Squared Errors
**SS: Sum-of-Squared Errors

Table 8.2: Clustering Results

Cluster	Percent(%)	Spending (KRW)	Long-term	Fresh	Frozen
4	42.35	11,863	0.88	0.08	0.05
3	28.63	12,081	0.11	0.85	0.04
1	23.01	17,166	0.16	0.15	0.69
2	6.01	78,084	0.51	0.21	0.27

Table 8.3: Characteristics of Clusters

Clusters		Distribution of Retailers					
		Superstore	SSM	Small and Medium Supermarket	Traditional Market	Obs.	Percent
Long-term Storage	4	48.8%	56.8%	52.2%	15.6%	97,566	42.4%
Fresh Foods	3	8.9%	16.3%	24.5%	49.0%	65,943	28.6%
Frozen Storage	1	19.4%	22.9%	19.2%	32.1%	53,006	23.0%
Highest Spending	2	22.9%	4.0%	4.1%	3.3%	13,847	6.0%
Obs.		25,763	18,728	124,124	61,747	230,362	
Percent		11.2%	8.1%	53.9%	26.8%	100%	

Table 8.3 shows the distribution of the purchases included in each cluster by the type of retail store. As the number of purchases was asymmetrically distributed in the data by each type of retail store, the conditional probabilities are represented in each cell in Table 8.3. That

is, the sum of each column becomes 100%. We can see which type of shopping baskets mainly consist of purchases made at each type of retail business. The estimation results shows that the shopping baskets of consumers who visit superstores, SSMs, and small- and medium-sized supermarkets are similar, while the shopping baskets made at traditional markets are different from those. The results also suggest that traditional markets compete with small- and medium-sized supermarkets in fresh foods, livestock products, and marine products.

8.2.2 Econometric Approach

An econometric model is used to back up the estimation result from clustering. The fixed-effect panel regression model is applied to deal with the store fixed effects. The estimated model is expressed as Equation (8.1):

$$\ln(sales)_{it} = \beta_0 + \beta_1 Restricted_{it} + \beta_2 Market_{it} + \theta_t + \alpha_i + \epsilon_{it}, \quad (8.1)$$

where i is the region, and t is the date.

The regression Equation (8.1) is estimated for each product category. The dependent variable is the logarithm of daily sales of each product category in a supermarket in region i at time t, $\ln(sales)_{it}$. $Restricted_{it}$ is the dummy variable indicating whether region i is un-

der the restriction policy on date t, $Market_{it}$ is the dummy variable indicating whether there is a five-day market open on the date t in region i, θ_t is the time-specific effect, such as the year effect and the month effect, and α_i is the region-specific effect. The variables of interest are $Restricted_{it}$ and $Market_{it}$. Their coefficients represent the exogeneous shocks in the retail market in region i. Therefore, these variables can show the asymmetric changes in the consumer's baskets due to changes in the retail market.

Table 8.4 shows the regression results of Equation (8.1). Sales of all product categories except alcohol increased on the day when SSMs and superstores closed due to the Sunday shopping restriction policy, of which consumer shows similar consumption baskets to small- and medium-sized supermarkets. The sales of each product category increased by 8-11% on the mandated days of closing. On the days of five-day markets, when traditional markets are open near the supermarket, sales of livestock products, vegetables, and fruits decline. The sales of livestock products, vegetables and fruits decreased by more than 3%. This is the result of a change in the composition of the consumers who visit on those days. This substitution pattern also affects the total sales of small and midsize stores. The effects of the mandated day of closing and five-day market open on the number of visitors and the total sales are annexed in the appendix. Table 8.5 shows the regression results of Equation (8.1) with same product categories as those of the clustering results. The estimation results suggests similar results

to the clustering results.

Table 8.4: Estimation Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Marine Products	Processed Food	Grains	Livestock Products	Alcohol	Vegetables	Fruits
Restricted Day	0.095***	0.112***	0.089***	0.107***	0.044	0.088***	0.107***
	(0.036)	(0.015)	(0.029)	(0.020)	(0.043)	(0.016)	(0.018)
Five-day Market	-0.053	-0.017	-0.037	-0.035*	0.017	-0.032**	-0.037**
	(0.033)	(0.014)	(0.027)	(0.018)	(0.040)	(0.015)	(0.017)
National Holiday	-0.082*	0.047**	-0.021	0.079***	0.193***	-0.058***	0.026
	(0.047)	(0.020)	(0.037)	(0.025)	(0.055)	(0.021)	(0.023)
Monday	0.023	-0.158***	-0.121***	-0.223***	-0.371***	0.062***	-0.189***
	(0.032)	(0.013)	(0.025)	(0.017)	(0.038)	(0.014)	(0.016)
Tuesday	-0.02	-0.203***	-0.174***	-0.243***	-0.390***	0.037***	-0.196***
	(0.032)	(0.013)	(0.025)	(0.017)	(0.038)	(0.014)	(0.016)
Wednesday	-0.042	-0.229***	-0.207***	-0.243***	-0.350***	0.004	-0.214***
	(0.030)	(0.013)	(0.024)	(0.017)	(0.036)	(0.014)	(0.015)
Thursday	-0.012	-0.220***	-0.241***	-0.213***	-0.331***	0.048***	-0.180***
	(0.032)	(0.013)	(0.025)	(0.017)	(0.038)	(0.014)	(0.016)
Friday	0.087***	-0.166***	-0.175***	-0.061***	-0.070*	0.138***	-0.082***
	(0.032)	(0.013)	(0.025)	(0.017)	(0.038)	(0.014)	(0.016)
Saturday	0.203***	-0.023*	-0.063**	0.090***	0.182***	0.177***	0.100***
	(0.032)	(0.013)	(0.025)	(0.017)	(0.038)	(0.014)	(0.016)
Region FE	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y
Month FE	Y	Y	Y	Y	Y	Y	Y
Obs.	3,652	3,656	3,656	3,656	3,656	3,656	3,656
$Adj.R^2$	0.577	0.817	0.485	0.422	0.275	0.802	0.805

Table 8.5: Estimation Results with Reclassified Product Category

	(1)	(2)	(3)
	Long-term Storable Foods	Fresh Foods	Frozen storage
Restricted Day	0.112***	0.088***	0.095***
	(0.015)	(0.016)	(0.036)
Five-day market	-0.017	-0.032**	-0.053
	(0.014)	(0.015)	(0.033)
National Holiday	0.047**	-0.058***	-0.082*
	(0.020)	(0.021)	(0.047)
Monday	-0.158***	0.062***	0.023
	(0.013)	(0.014)	(0.032)
Tuesday	-0.203***	0.037***	-0.020
	(0.013)	(0.014)	(0.032)
Wednesday	-0.229***	0.004	-0.042
	(0.013)	(0.014)	(0.030)
Thursday	-0.220***	0.048***	-0.012
	(0.013)	(0.014)	(0.032)
Friday	-0.166***	0.138***	0.087***
	(0.013)	(0.014)	(0.032)
Saturday	-0.023*	0.177***	0.203***
	(0.013)	(0.014)	(0.032)
Region FE	Y	Y	Y
Year FE	Y	Y	Y
Month FE	Y	Y	Y
Obs.	3,656	3,656	3,652
$Adj.R^2$	0.817	0.802	0.577

9 Conclusion

In this paper, three research questions were answered. First, is the Sunday shopping restriction policy effective? There were positive effects on small- and medium-sized supermarkets, whereas there were limited effects on traditional markets. According to the analysis on the impact of the policy, consumers using superstores and SSMs change their shopping days to Saturday and Monday, and they also change

their shopping place to small- and medium-sized supermarkets on the mandated days of closing. However, the shift to traditional markets was limited. Based on the estimated transfers of sales, 35% of the reduced sales of superstores and SSMs were retained, about 40% were transferred to small- and medium-sized supermarkets, and less than 1% of the reduced total sales were transferred to traditional markets.

Second, do consumers respond differently to the Sunday shopping restriction policy according to their purchase patterns? Consumers responded differently to the policy depend on how frequently they visit each type of retail stores. Consumers who most frequently visit superstores and SSMs showed spatial substitution to small- and medium-sized supermarkets on the mandatory closed days. Consumers who focused on traditional markets did not respond much to the policy. Clustering analysis showed that most of the consumers used various retail stores instead of one type of retailer, and these consumers were found to respond most to the Sunday shopping restriction policy. Therefore, consumers' experience of visiting traditional markets was an important factor for improving effectiveness of the policy on traditional markets. Therefore, our findings suggest that other types of indirect supports to traditional markets, such as refurbishment and distribution of vouchers for traditional markets, can help to promote the impact of the Sunday shopping restriction policy.

Third, do consumption baskets differ depending on the type of retail store that consumers visit? According to the results, consumers spend a lot on processed foods in superstores, SSMs, and small- and medium-sized supermarkets. In this respect, substitution among these three types of retail stores appeared frequently. Therefore, it was more likely that consumers replace superstores and SSMs with small- and medium-sized supermarkets. On the other hand, we can see why there was not much effect of the policy on traditional markets. Consumers' shopping baskets in traditional markets were most likely filled with marine products, livestock products, and fresh foods. We can conclude that traditional markets are not a sufficient substitute for superstores and SSMs. Therefore, regulation on product categories that superstores and SSMs sell, which is suggested by some previous studies, can be supported by this results.

Overall, our findings suggest that the Sunday shopping restriction policy has positive effects on small- and medium-sized supermarkets. However, the policy does not effectively help traditional policy. To increase the positive impacts on traditional markets, the regulation should be accompanied by other efforts, including refurbishment of facilities, issue of voucher, and expansion of parking space.

Appendix

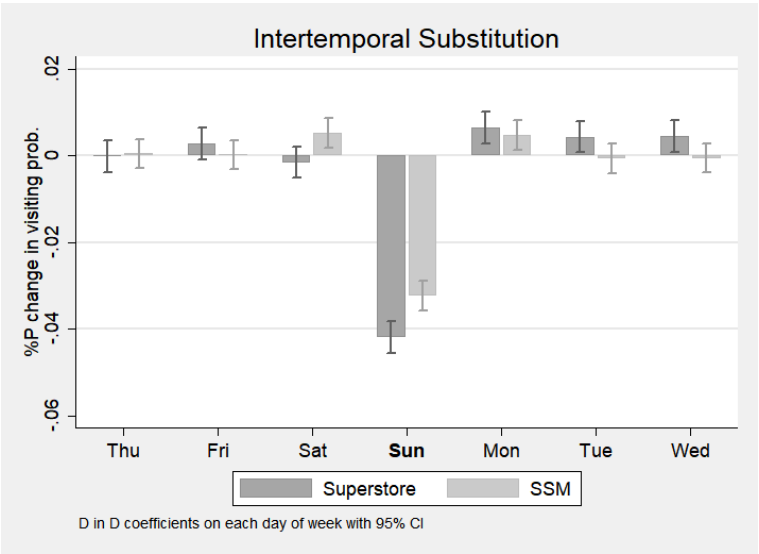


Figure A.1: Inter-temporal Substitution

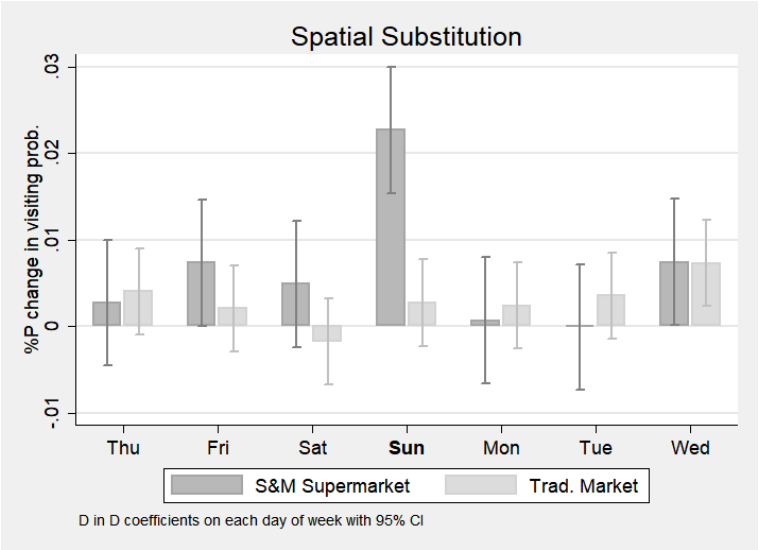


Figure A.2: Spatial Substitution

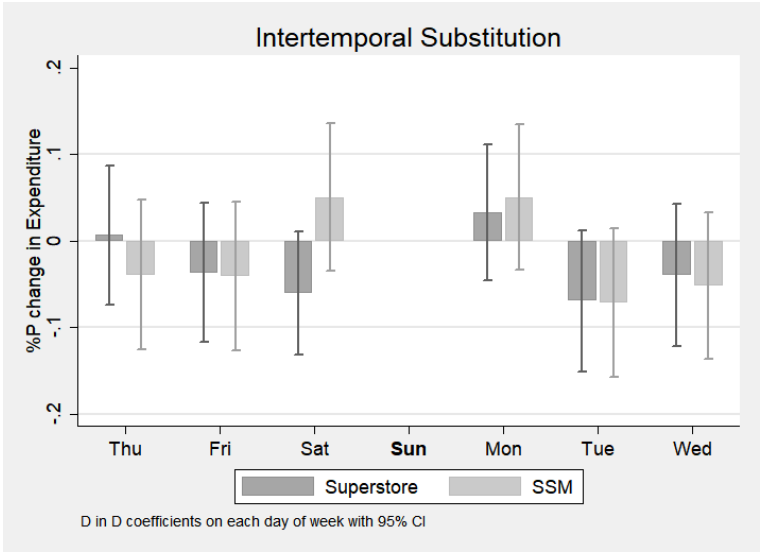


Figure A.3: Inter-temporal Substitution (Expenditure)

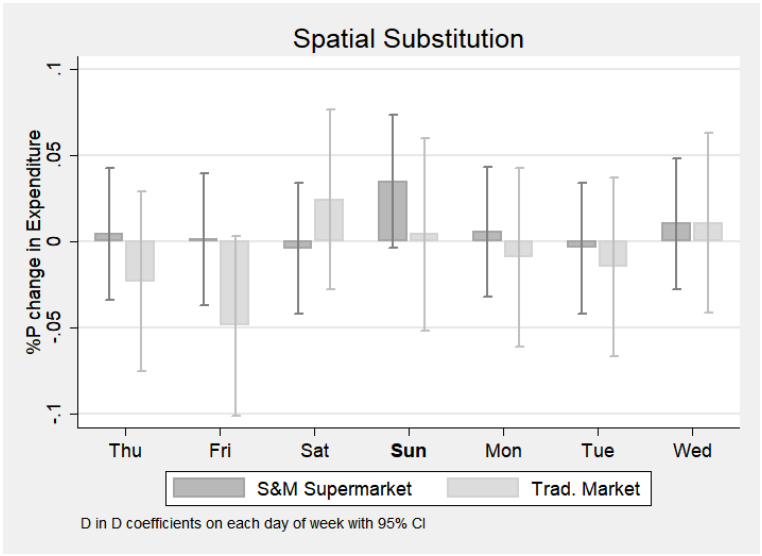


Figure A.4: Spatial Substitution (Expenditure)

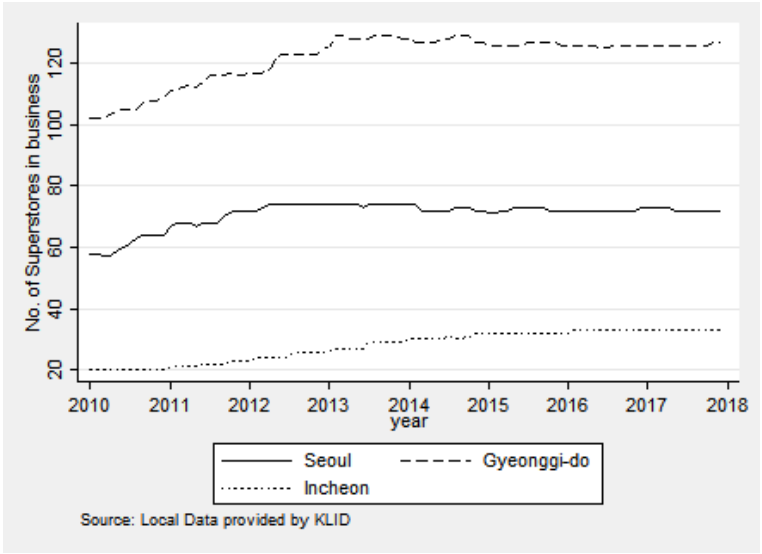


Figure A.5: Trends in the Number of Superstores

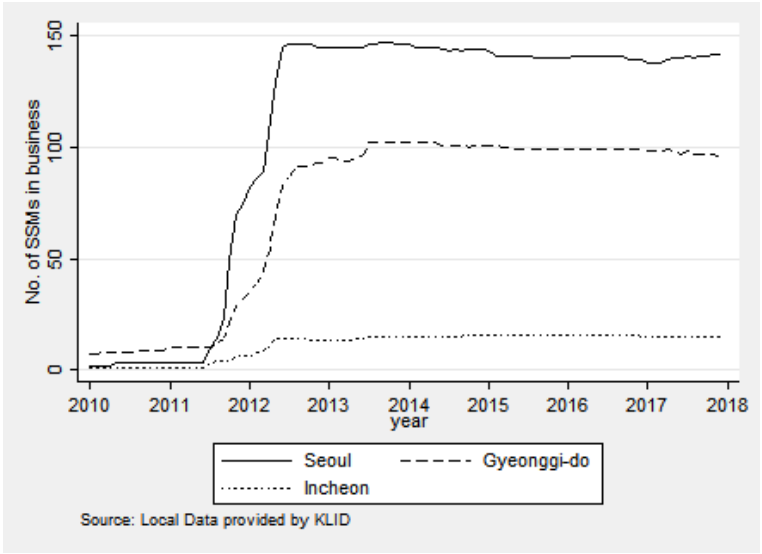


Figure A.6: Trends in the Number of SSMs

Inter-week Substitution

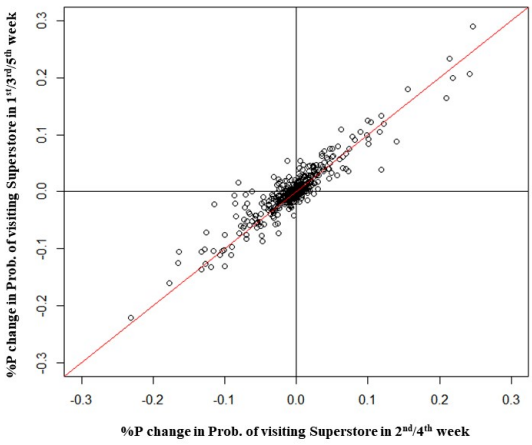


Figure A.7: Inter-Week Substitution: Superstore

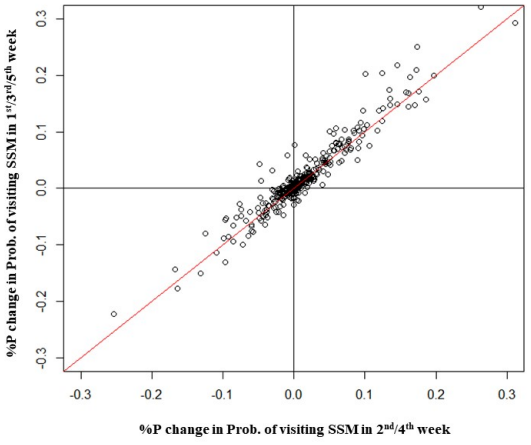


Figure A.8: Inter-Week Substitution: SSM

In Figure A.7 and Figure A.8, the X-axis represents the changes in visit probability of a type of retail stores in the second and fourth weeks, and the Y-axis represents those in the first, third, and fifth weeks. The households plotted in the second quadrant of each graph are considered that they shift their shopping days from the treatment period to the control period due to the Sunday shopping restriction policy. In the sample, there are 56 households in the second quadrant of the graph for superstores, and 32 households for SSMs.

$$y_{im} = \beta_0 + \beta_1 Post_{im} + \beta_2 Z_{im-1} + \beta_3 (Post_{im} \times Z_{im-1}) + \theta' X_{im} + \delta_m + \alpha_i + \epsilon_{im}, \quad \text{(A.1)}$$

where i is the household, and m is the month.

In Equation (A.1), y_{im} is the dummy variable indicating whether household i visits a type of retail stores on the Sundays in the first, the third, and the fifth week in the month m at least once, Z_{im} is the dummy variable indicating whether household i visits a type of retail stores on the Sundays in the month m at least once[19], $Post_{im}$ is the dummy variable indicating whether the month m is after the enforcement of the Sunday shopping restriction policy in region where household i resides, X_{im} is a vector of household's demographic vari-

[19]The lagged variable, Z_{im-1} was used in Equation (A.1) to prevent reverse causality problem.

ables, δ_m is the month effect, and α_i is household i's fixed effect. The variable of interest is the interaction term, $(Post_{im} \times Z_{im-1})$, which represents the changes in probability of visiting a type of retail stores in the control periods after the policy was implemented. According to the estimation results in Table A.1, there was no statistical significant changes in probability of visiting superstores and SSMs after the policy was implemented.

Table A.1: Estimation Results for Equation (A.1)

	(1)	(2)
	Superstore	SSM
$Post_{im}$	0.003	-0.007
	(0.009)	(0.007)
$Z_{im-1}^{superstore}$	0.055***	
	(0.007)	
$Post_{im} \times Z_{im-1}^{superstore}$	-0.001	
	(0.010)	
Z_{im-1}^{ssm}		0.117***
		(0.007)
$Post_{im} \times Z_{im-1}^{ssm}$		-0.011
		(0.010)
Constant	0.003	0.053*
	(0.035)	(0.029)
N	31,598	31,598
R^2	0.014	0.025

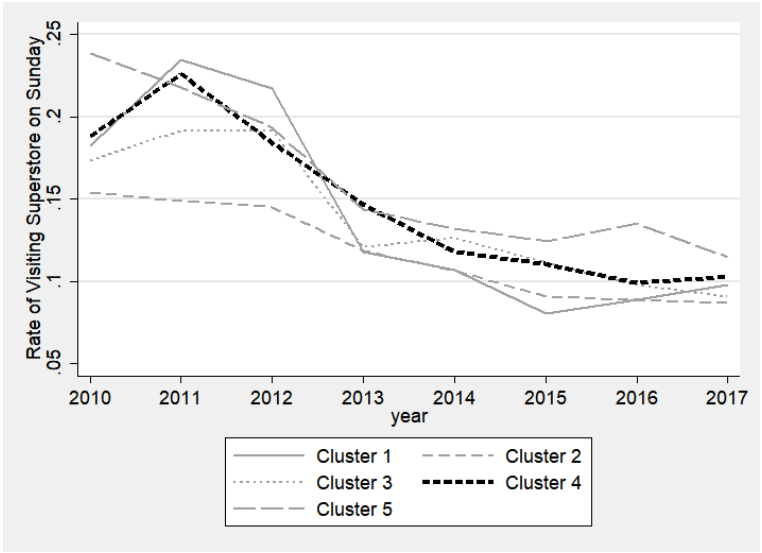


Figure A.9: Probability of visiting superstores on Sunday by Cluster

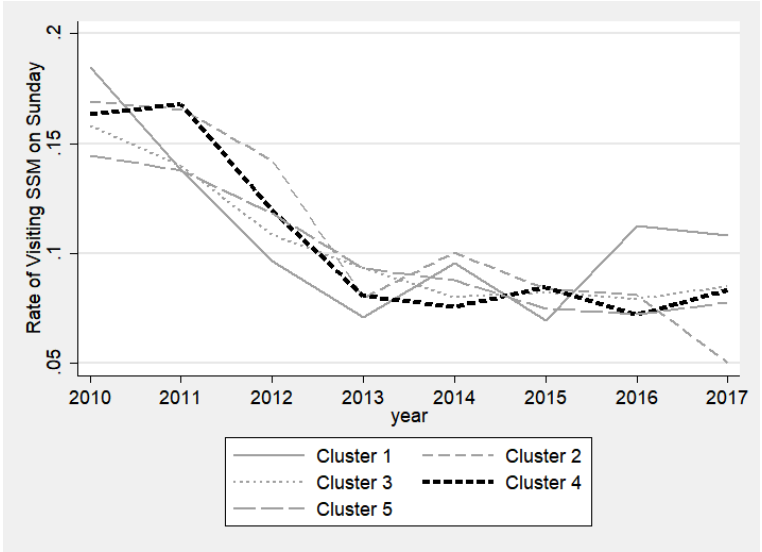


Figure A.10: Probability of visiting SSMs on Sunday by Cluster

Table A.2: Estimation results

	(1)	(2)	(3)
	Total Sales	No. of Visitors	Sales per Person
Restricted Day	0.096***	102.809***	0.045***
	(0.011)	(9.768)	(0.006)
Five-day market	-0.032***	-38.858***	-0.006
	(0.010)	(9.054)	(0.006)
National Holiday	0.042***	46.143***	-0.010
	(0.014)	(12.587)	(0.008)
Monday	-0.134***	-135.305***	-0.006
	(0.009)	(8.579)	(0.005)
Tuesday	-0.165***	-162.376***	-0.016***
	(0.009)	(8.571)	(0.005)
Wednesday	-0.178***	-179.210***	-0.019***
	(0.009)	(8.222)	(0.005)
Thursday	-0.162***	-162.762***	-0.009*
	(0.009)	(8.582)	(0.005)
Friday	-0.084***	-120.684***	0.029***
	(0.009)	(8.592)	(0.005)
Saturday	0.046***	-16.023*	0.060***
	(0.009)	(8.577)	(0.005)
Region FE	Y	Y	Y
Year FE	Y	Y	Y
Month FE	Y	Y	Y
Obs.	3,656	3,656	3,652
$Adj.R^2$	0.876	0.879	0.847

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Abstract in Korean

본 논문에서는 대형소매점에 대한 의무휴업일제도의 실효성을 평가하고자 한다. 의무휴업일제도는 중·소형 소매점과 전통시장을 보호하기 위해 시행된 만큼 소매업태들의 후생에 어떤 영향을 미쳤는지를 파악하고자 한다. 대형소매점에 대한 규제가 소비자들을 중·소형 소매점과 전통시장으로 유도하였는지를 평가하기 위해, 본 논문에서는 소비자들의 소매업태 선택에 집중하여 분석한다. 제도로 인해 소비자들의 소매업태 선택이 어떻게 바뀌었는지를 분석하고, 이를 바탕으로 소비자들의 소비가 얼마나 소매업태 간에 이전이 되었는지를 추정한다. 추정된 소비 이전 정도를 바탕으로 의무휴업일제도로 인해 발생하는 대형마트와 SSM의 매출 감소분의 몇 퍼센트(%)가 다시 대형마트와 SSM으로 돌아가고, 몇 퍼센트(%)가 중·소형 소매점과 전통시장으로 이전되었는지를 분리하여 추정한다. 또한 본 논문에서는 규제의 효과에 영향을 미치는 요인을 파악한다. 이를 위해 소비자들의 구매 패턴을 파악하고, 소비자들의 구매 패턴이 규제의 효과에 어떤 영향을 주고 있는지를 분석한다. 구체적으로 본 논문에서는 두 가지 추가 분석을 진행한다. 첫째, 소비자들의 소매업태 방문 패턴을 살펴보며, 어떤 방문 패턴을 가지던 소비자들이 의무휴업일제도에 가장 크게 반응하는지를 파악한다. 둘째, 소비자들이 각 소매업태에서 구성하는 장바구니를 살펴보며, 소매 업태별로 차별적으로 나타나는 규제 효과의 요인을 파악한다.

주요어 : 의무휴업일제도, 소매업태, 소비자 행동, 농식품 구매, 이중차분법, K-평균 군집화, 장바구니 분석

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